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A search ^{7}Be in solar energetic particle events

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Abstract. The LDEF spacecraft measured an unexpectedly high level of ^{7}Be, presumably swept up from the residual atmosphere. However, it is unclear whether the atmospheric ^{7}Be is due to particles originating in nuclear reachtions at the Sun, or due to secondary fragments from collisions between energetic particles (solar and galactic) and the atmosphere. The Solar Isotope Spectrometer (SIS) on ACE has been measuring solar energetic particles since launch in 1997. We will present the results of a search for solar ^{7}Be above about 5 MeV/nucleon with the SIS instrument.

1 Introduction

After its recovery in January 1990, the Long Duration Exposure Facility (LDEF) was discovered to have collected a large amount of the radioactive isotope beryllium-7 (half-life 53.3 days) on its forward-facing surfaces (Fishman *et al.*, 1991; Phillips *et al.*, 1991). The amount of ^{7}Be measured required a concentration at LDEF altitude (> 320 km) that was thousands of times higher than has been measured in the atmosphere at 20 – 50 km (Lal and Peters 1967).

In the months before LDEF recovery, the Sun was very active, and it was suggested that the solar energetic particle (SEP) events and flares in this time period contributed to the level of ^{7}Be recorded (Gregory 1996; Share and Murphy 1997). Two processes have been suggested for the ^{7}Be increase. Either there was increased fragmentation of atmospheric nitrogen and oxygen by the SEPs (which, in addition to cosmic ray interactions, is believed to be the source of the low altitude beryllium), or there was an enhanced level of ^{7}Be in the SEP population itself. During flares, ^{7}Be can be produced by α-α fusion in the solar atmosphere (Kozlovsky and Ramaty 1974; Kuzhevskij and Lur'e 1997). A recent series of experiments (Phillips *et al.* 2001) indicate that the ^{7}Be concentration is correlated with SEP fluences, but not with solar activity as measured by the x-ray fluence.

The Solar Isotope Spectrometer (SIS) (Stone et al. 1998) on the Advanced Composition Explorer (ACE) has been measuring SEPs beyond the Earth's magnetosphere for more than 3 ½ years. With its large geometry factor (40 cm^2 sr) and excellent mass resolution, SIS may be able to observe the flux of ^{7}Be coming from the flare site. Preliminary analysis of SIS data shows no measurable fluence of ^{7}Be between about 5 and 70 MeV/nucleon. Upper limits on the ^{7}Be fluence and its relationship to the measured atmospheric ^{7}Be will be presented at this conference.

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